

THE NEED FOR A GENE BANK FOR FOREST GERMLASM

Dr. Suman Sahai

Introduction

The forest cover of India ranges from tropical rain forests in the Andaman and Nicobar Islands in the south, to dry alpine forests in the Himalayas in the north. In between, the country has semi-evergreen forests, thorn forests, sub-tropical broad-leaved hill forests, sub-tropical pine forests and montane temperate forests. India has the largest bamboo resources in the world.

The definitions and statistics relating to the forests in India are based on both 'recorded' forest lands under legal classification, mostly owned by the government, as well as 'forest cover', indicating lands with forest vegetation, regardless of ownership.

India has a total of 76.77 million ha. (14) of 'recorded' forests (23.42% of land area). Within this total, there are 41.49 million ha. of 'Reserved' forests, 22.97 million ha. of 'Protected' forests, and 12.2 million ha. of 'Unclassified' forests.

As per the 1995 assessment report of the Forest Survey of India based on satellite data interpretation, the actual forest cover of India is 6,39,600 sq. km., which is 19.47% of the total geographic area of the country. Of this, 3,85,756 sq. km. (11.73%) is dense forest cover, (crown density 40% and above), 2,49,311 sq. km. (7.61%) is open forest cover (crown density 10% to less than 40%), and 4,533 sq. km. (0.13%) is mangrove area. This clearly indicates that India has at present only 11.73% of good forest cover, as against the 1988 National Forest Policy goal of 33% of land area under forest cover. In addition, there are 5.89 million ha. of 'scrub areas', which are included in the definition of 'recorded' forests, and represent highly degraded or barren 'forest' lands without significant tree cover (less than 10% crown cover).

16 major forest types have been identified in India (Champion & Seth, 1968)

1. Wet Evergreen Forests cover 51,249 sq.km. This is dense, tallforest, 45 metres or more in height, entirely evergreen, or nearly so. No species occurs gregariously, and no individual species forms more than 1% of the upper canopy.
2. Semi-Evergreen Forests cover 26,424 sq.km. Dominants include deciduous species, but evergreens predominate. The general canopy is typically less dense than the true evergreen forests.
3. Moist Deciduous Forests cover 236,794 sq.km. Dominants are mainly deciduous, but sub-dominants and lower canopy are largely evergreen. The canopy is rarely dense and even, but over 25 metres high.
4. Littoral and Swamp Forests extend over 4,046 sq.km. They are mainly evergreen, of varying density and height, but always associated with wetness.
5. Dry Deciduous Forests extend over 186,620 sq.km. They are entirely deciduous, or nearly so. The top canopy is rather light and rarely over 25 metres high -- usually 8-20 meters.

6. Thorn Forests cover 16,491 sq. km. They are deciduous, with low thorny trees. The canopy is more or less broken. The height is less than 10 meters.
7. Dry Evergreen Forests cover 1,404 sq. km. Hard-leaved evergreen trees predominate, with some deciduous emergents. These forests are often dense, but usually less than 20 metres high.

The sub-tropical group has three type groups:

8. Sub-tropical Broad-leaved Hill Forests extend over 2,781 sq. km. This type consists of broad-leaved, largely evergreen high forest.
9. Sub-tropical Pine Forests extend over 41,377 sq km. Pine species predominate.
10. Sub-tropical Dry Low Evergreen Forests, covering 12,638 sq. km., consist of xerophytic forest and scrub.

Temperate Forests comprise three type groups:

11. Montane Wet Evergreen Temperate Forests, covering 23,365 sq.km, consist of forest without conifers.
12. Himalayan Dry Temperate Forests occur over 22,012 sq.km. And are generally open coniferous forests with mainly oaks, cedars, firs and other conifers.
13. Himalayan Dry Temperate Forests are open coniferous forests with sparse xerophytic undergrowth.

Alpine forests are met with only in the Himalayas and connected ranges. Above the tree line, high forests are replaced by alpine scrub, varying in form with the available moisture supply. *In alpine forests three types are recognized:*

14. Sub-alpine Forests, spread over 18,628 sq.km, consist of stunted, deciduous or evergreen trees, usually in close formation, with or without conifers.
15. Moist Alpine Scrub consists of low, but often dense, scrub. Species include *Betula* and *Rhododendron*.
16. Dry Alpine Scrub consists mainly of xerophytic scrub in open formation -- mostly *Juniperus*.

The need for conserving forest germplasm

It is obvious to all concerned with the subject that Indian forests are facing a severe onslaught threatening their very existence. The need for conservation is acute and immediate. Conservation strategies are of two kinds: *in situ* and *ex situ* conservation

In-situ Conservation

Plant wealth is maintained in its natural habitat, within the community of which it forms a part. For the majority of situations in-situ conservation is the ideal method of conserving wild plant genetic resources as it is

In-situ conservation strategies include biosphere reserves, gene sanctuaries, National parks and Preservation plots. In order to protect biodiversity in its totality, the Ministry of Environment and Forests has identified 25 areas as biosphere reserves. Nine have been already notified seven are yet to be notified and nine more sites have been further suggested by expert groups.

Ex - situ Conservation

Plant wealth is maintained outside the natural habitat. Ex-situ conservation is an alternate method (complementary) to safeguard the particular plant species. Gene banks, herbal gardens, botanical gardens, arboreta etc. constitute the *ex-situ* conservation methods. *Ex-situ* conservation of seeds in a gene bank is the safest and cheapest method, used globally for orthodox seed germplasm. Two main types of seed collections are held in genebanks.

Active Collection

This is a collection of seed accessions for medium term storage. These collections are, frequently used for multiplication, regeneration, evaluation, characterisation documentation and distribution. These samples are maintained for medium term durations (3-10 years) under 35-40% relative humidity at 4 degrees C.

Base Collection

This is a collection of seed accessions for long-term conservation. These collections are conserved indefinitely as a broad base for posterity. These are dried to a moisture content of 3-5% and stored for long-term durations (10-15 years or more) under more exact and controlled environment (-20 C), to reduce the risk of genetic changes through frequent regeneration and to prevent genetic erosion of stored germplasm resulting from excessive deterioration.

What is a Gene Bank?

A Gene bank conserves plant genetic wealth instead of gold, rupees or other valuables. The rich heritage of plants, which feeds and sustains humankind, is conserved through seeds, vegetative propagules, tissue culture, embryos, gametes or cells, DNA etc. Besides orthodox seeds, vegetatively propagated clonal material and recalcitrant species are maintained under *in-vitro*, cryo and field conditions.

The importance of gene banks has been recognised since long and they have been in existence in various parts of the world for a long time. In India the largest, most modern gene bank was opened in New Delhi only a few years ago. This bank is primarily intended for the storage of crop species and their wild relatives.

Despite the subject having been flagged at recent discussions, no concrete action has yet started with respect to the setting up of a gene bank for forest germplasm. Given the rapid rate of destruction of forests around the world, including the Indian sub-continent, there is certain urgency about conserving the genetic material of the Indian forests.

The purpose of the Gene Bank is to

- Undertake and promote long-term conservation of plant genetic resources employing ex-situ conservation for seeds, in-vitro cultures and cryopreservation techniques and assist in in-situ conservation efforts.
- Act as the repository of collected material, elite material and endangered material, as also a regional repository of duplicate collections as a part of the global system.
- Monitoring and maintenance of the existing collections, facilitating the organisation of regeneration program.

- Ensuring availability of exotic and indigenous germplasm through periodic seed increase for evaluation, utilization and conservation.
- Conducting research related to medium and long-term conservation of germplasm.
- Developing and operating a database and information network system on forest genetic resources
- Support/assist in organisation of post-graduate education and short/medium-term training courses on Forest germplasm activities at national, regional, and international levels.

A forest gene bank will enable the execution of the following important goals:

* To have available a large diversity to ensure genetic variability while replanting and avoid the trap of monocultures during afforestation programs.

* To replant as wide as possible a species mix so as to have variation in fuel, fodder, non-timber produce and other economically valuable species.

*To improve and upgrade tree germplasm by modern methods of genetics research like recombinant DNA technology.

*To develop special characters like disease resistance, vigour and large size of economically relevant portions, in plantations of economically important species.

*To assess and conserve the range of special characteristics like medicinal use, yield of gums, resins etc. to plan sustainable commercial exploitation.

* To catalogue and maintain wild relatives of important plants.

*To develop improved, faster growing species to serve special goals like arresting coastal and other soil erosion.

*To develop cultivation technology and targeted tree breeding programs for afforestation, generating biomass and for commercial exploitation.

* Very specially with endemic species, we will need to document what is available and devise a plan for both in situ and ex situ conservation.